

RHIC pp RUN5 Performance

<http://www.agsrhichome.bnl.gov/AP/Spin2005/>

Outline

- The Goal of pp RUN5
- The performance of RUN5
 - What has been achieved
 - 100 GeV program
 - 205 GeV development
- What have we learned
- Summary

Goal of RHIC pp Run 05

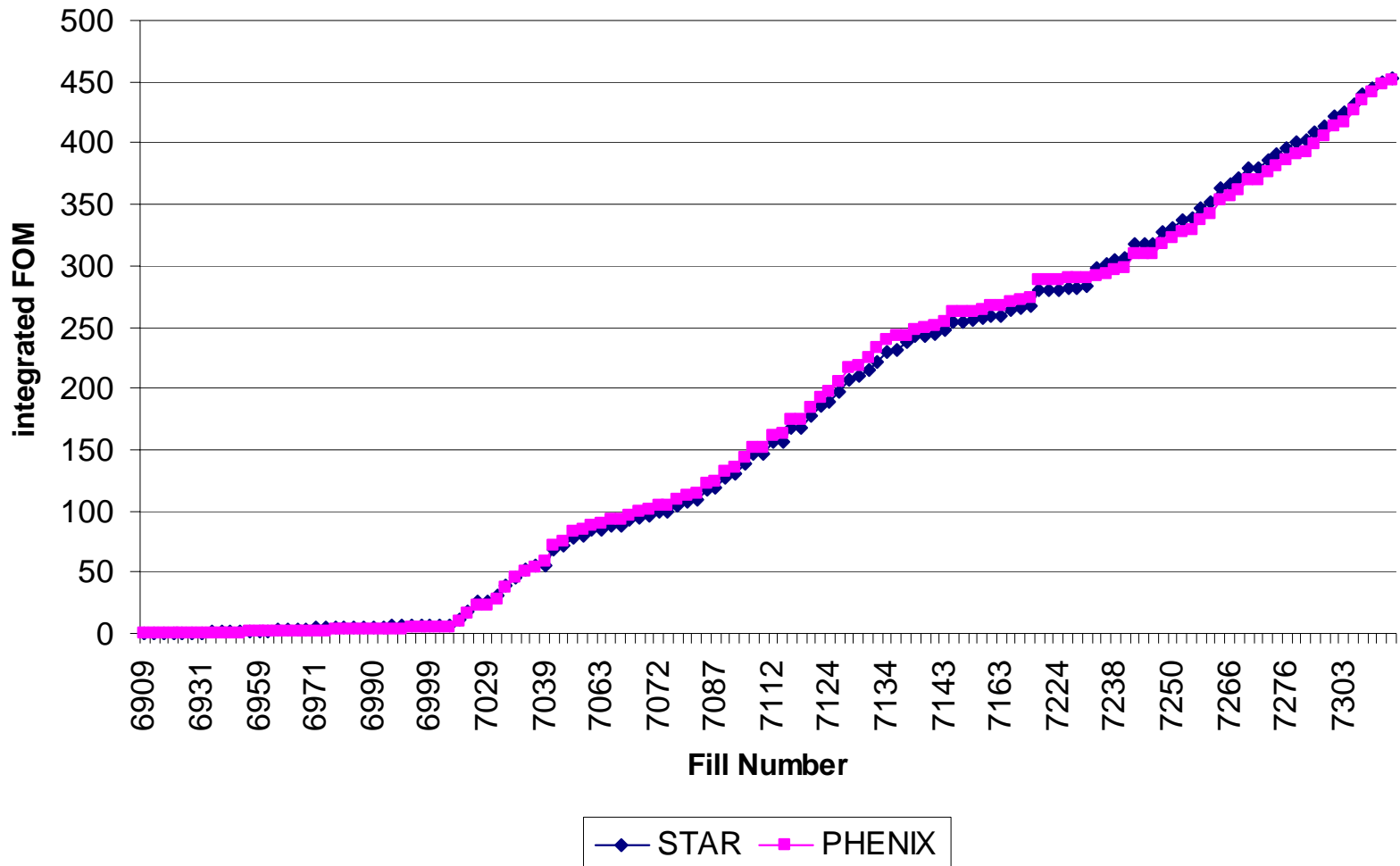
- Provide collisions at 100 GeV for experiments STAR, PHENIX and Brahms
 - Provided a total of 11.8 pb⁻¹ (June 21) luminosity with longitudinal polarization at STAR and PHENIX
 - Provided a total of 163 nb⁻¹ luminosity with transverse polarization at STAR and PHENIX
 - Successfully accelerated/collided 110x110 bunches with a bunch intensity of 1x10¹¹
- Explore the polarized proton acceleration beyond 100 GeV
 - Beams were accelerated and collided at 205 GeV
 - 30% polarization was measured in both rings at 205 GeV
 - Two polarization ramp measurements
 - An increase of 1mm vertical rms in yellow decreased the polarization transmission efficiency by close to a factor of 2
 - Push the Q_y away from 0.7 in Blue didn't affect the pol transmission efficiency

RHIC pp performance

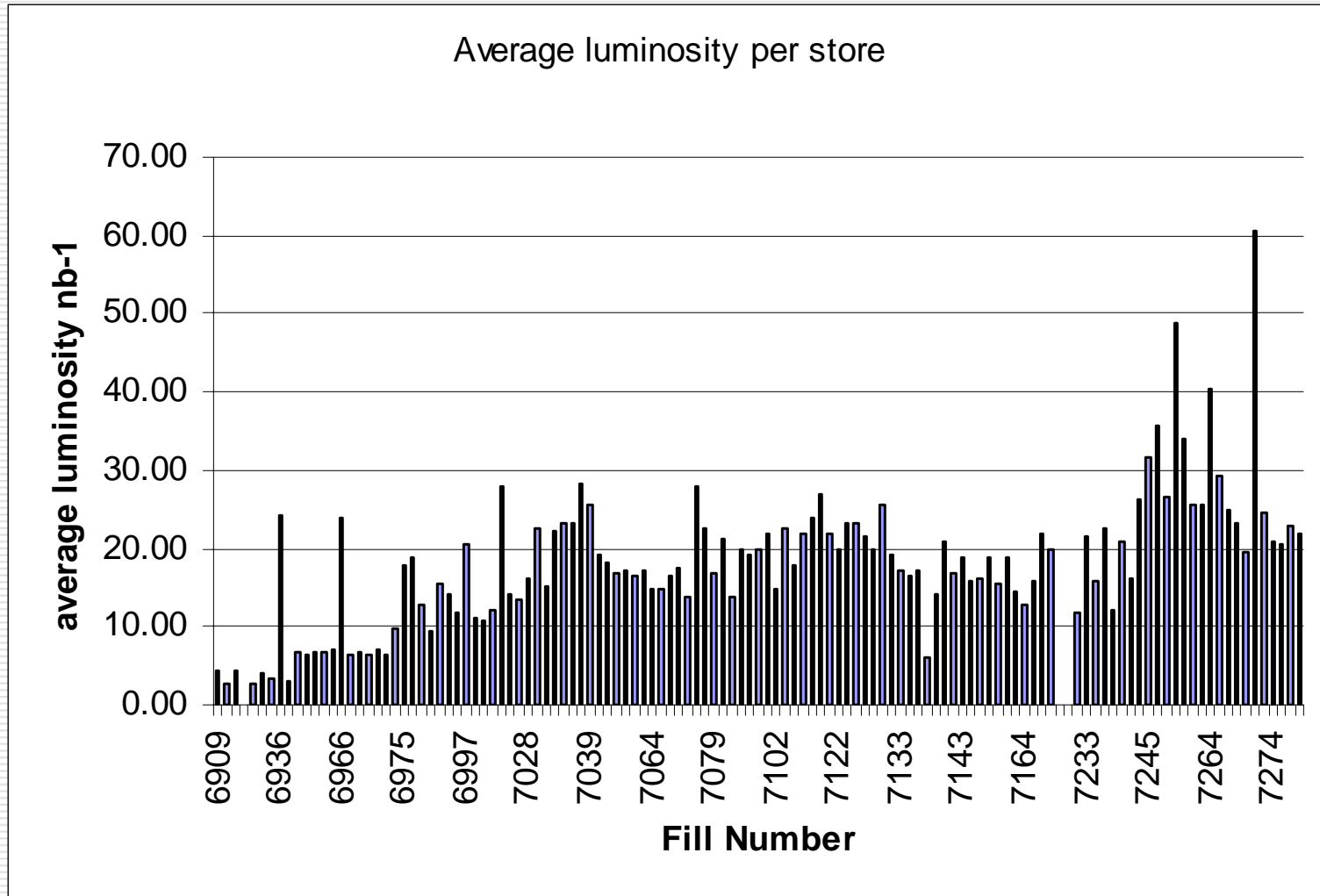
	Bunch intensity $\times 10^{11}$	# of Bunches	$\mathcal{L}_{\text{peak}}$ $\times 10^{30}$ $\text{cm}^{-2}\text{s}^{-1}$	$\mathcal{L}_{\text{store}}$ $\times 10^{30}$ $\text{cm}^{-2}\text{s}^{-1}$	\mathcal{L}_{wee} k pb^{-1}	Machine uptime	Pol at Store Blue/Yellow
FY04	0.7	56	5.4	4.0	--	--	40%
FY05 min	0.7	56	5.4	4.0	0.9	40%	40%
FY05 max	1.0	79	16	8.2	3.0	50%	45%
FY05 operation	1.0	84	9.0	4.9	1.2	52%	48.5/43.5
FY05 max	1.12 (61 bunches)	110 (0.95×10^{11} protons/bu nch)	13	8.2	1.8	--	61.9/58.4

Projection

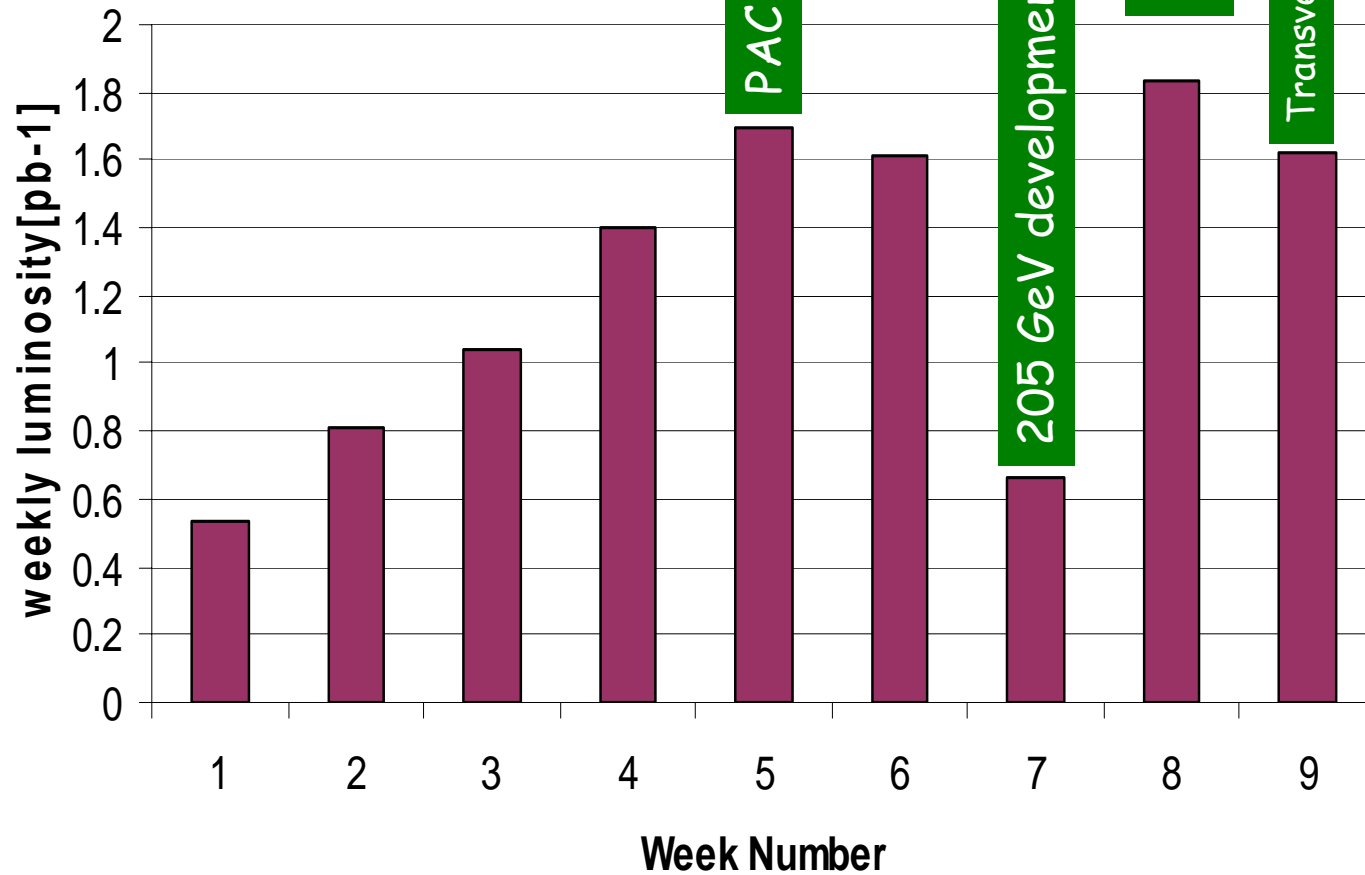
RHIC integrated FOM



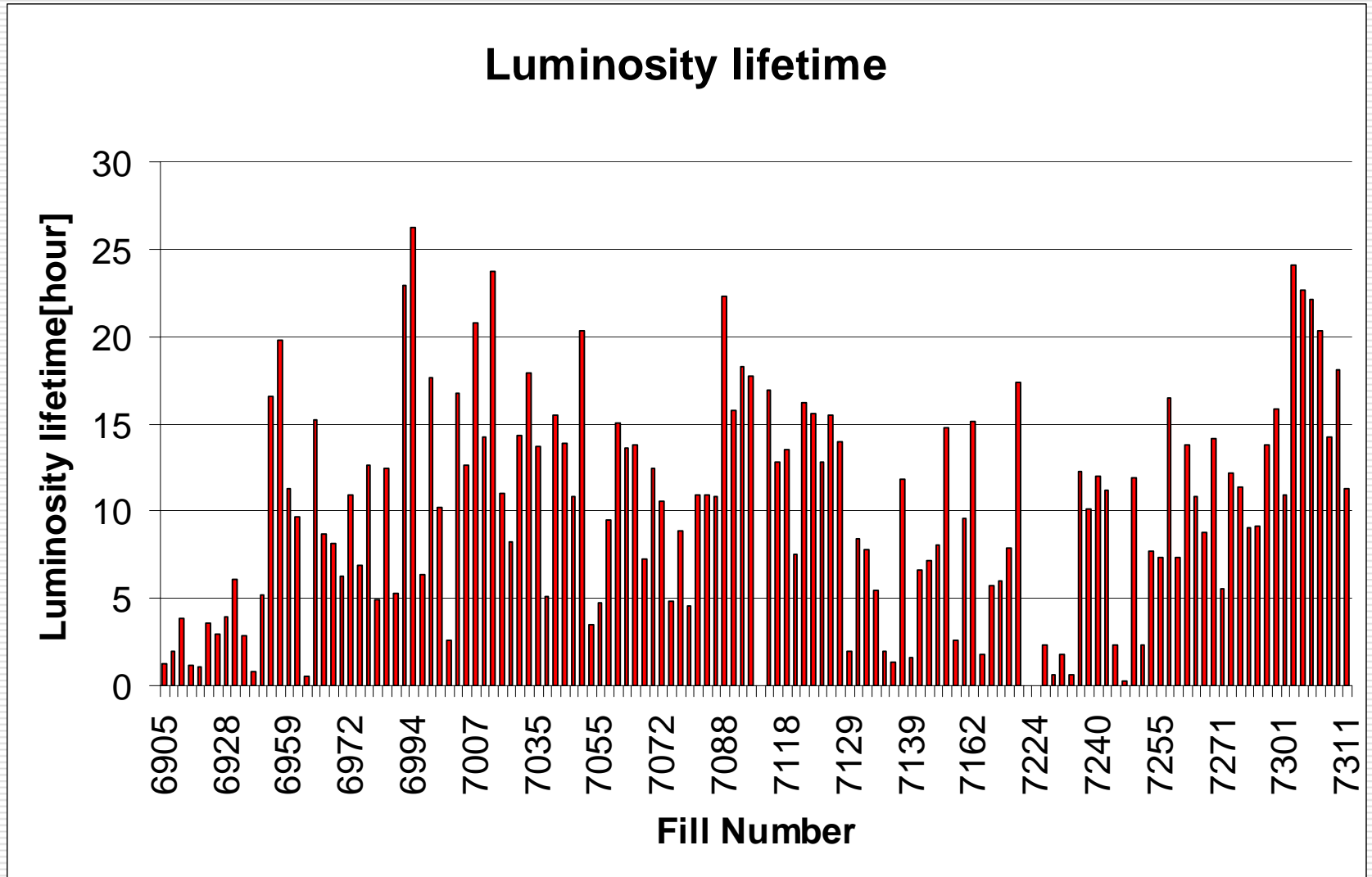
Average luminosity per store



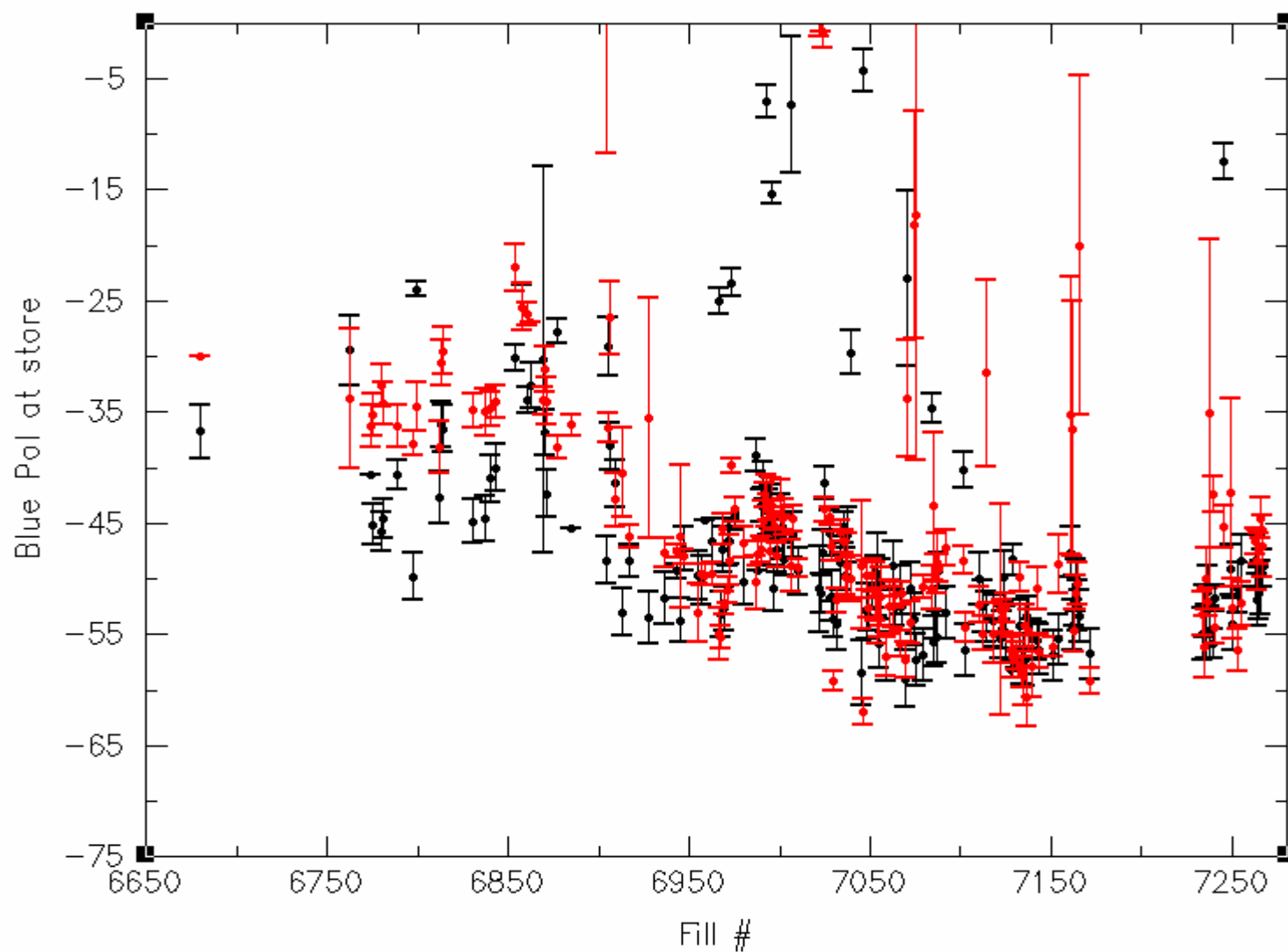
Average luminosity per week



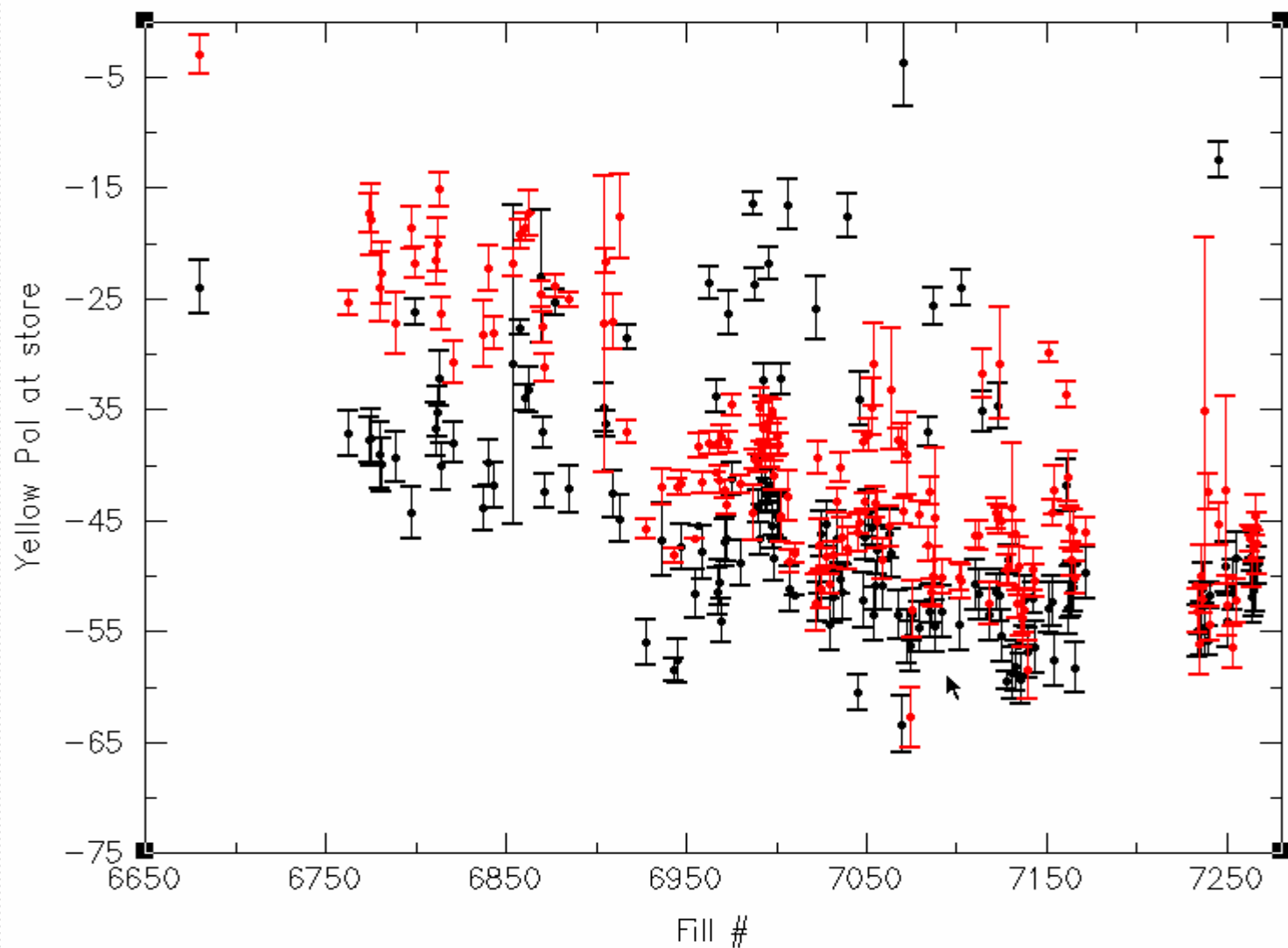
Luminosity lifetime



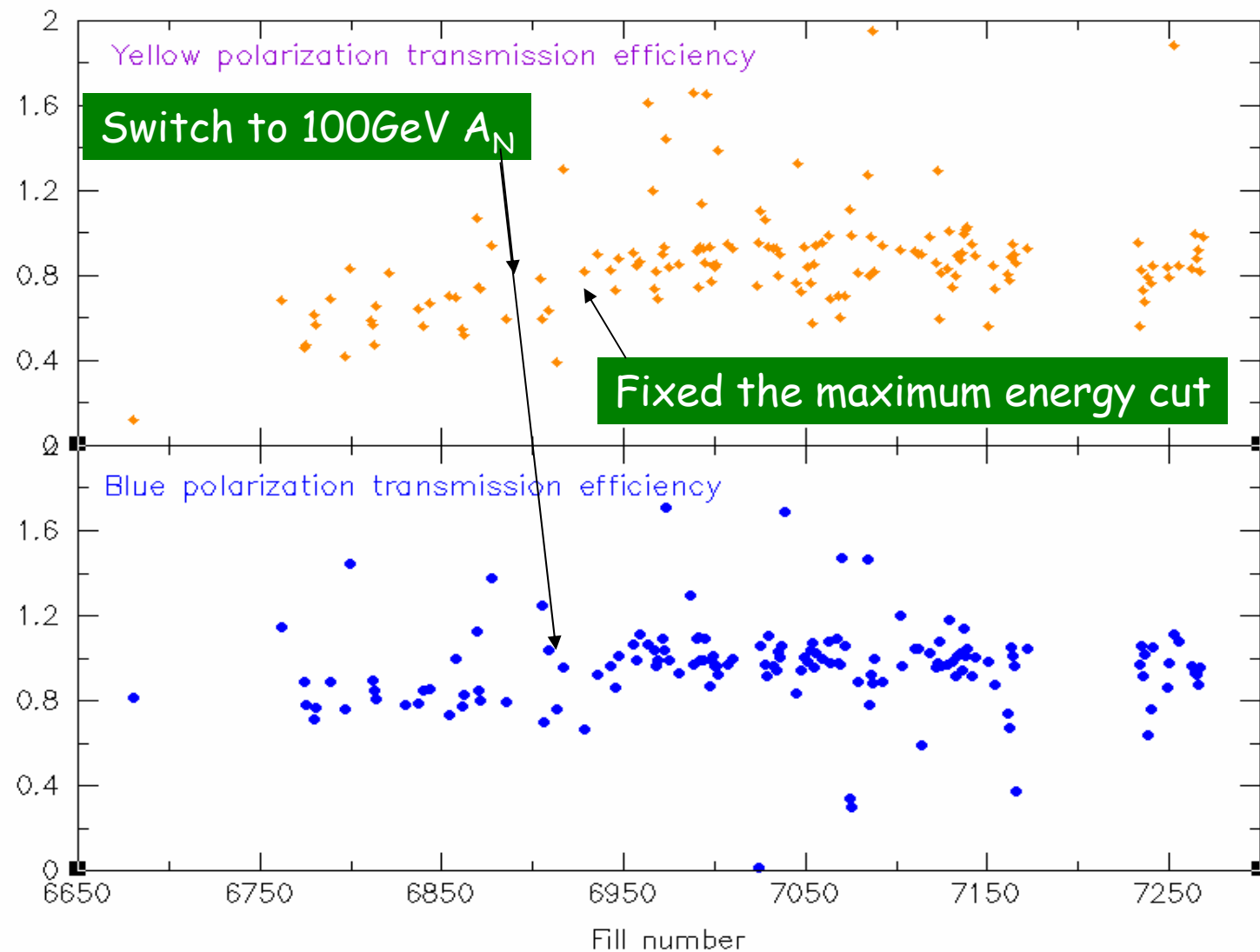
Achieved polarization in Blue



Achieved polarization in Yellow



Polarization efficiency



What have we learned

- flat orbit vs. zero orbit
 - No difference in polarization transmission efficiency
 - But, flat orbit introduces stronger coupling and an enhancement on a imperfection resonance at $G\gamma=85$
- Daily variation of orbit
- Beam lifetime at store
 - Tighter momentum aperture in yellow than in blue
 - Dispersion function sensitive to the local angle bumps at IP6 and 8
 - Achieved beam-beam tune shift is smaller than expected
- STAR background issue
 - Background with 15% larger β^* yields similar background issue
 - Needs shielding
- Effect of Brahms magnet
- Yellow injection kicker slow rising time
 - Cause emittance blowup of the bunches which are 3-buckets apart

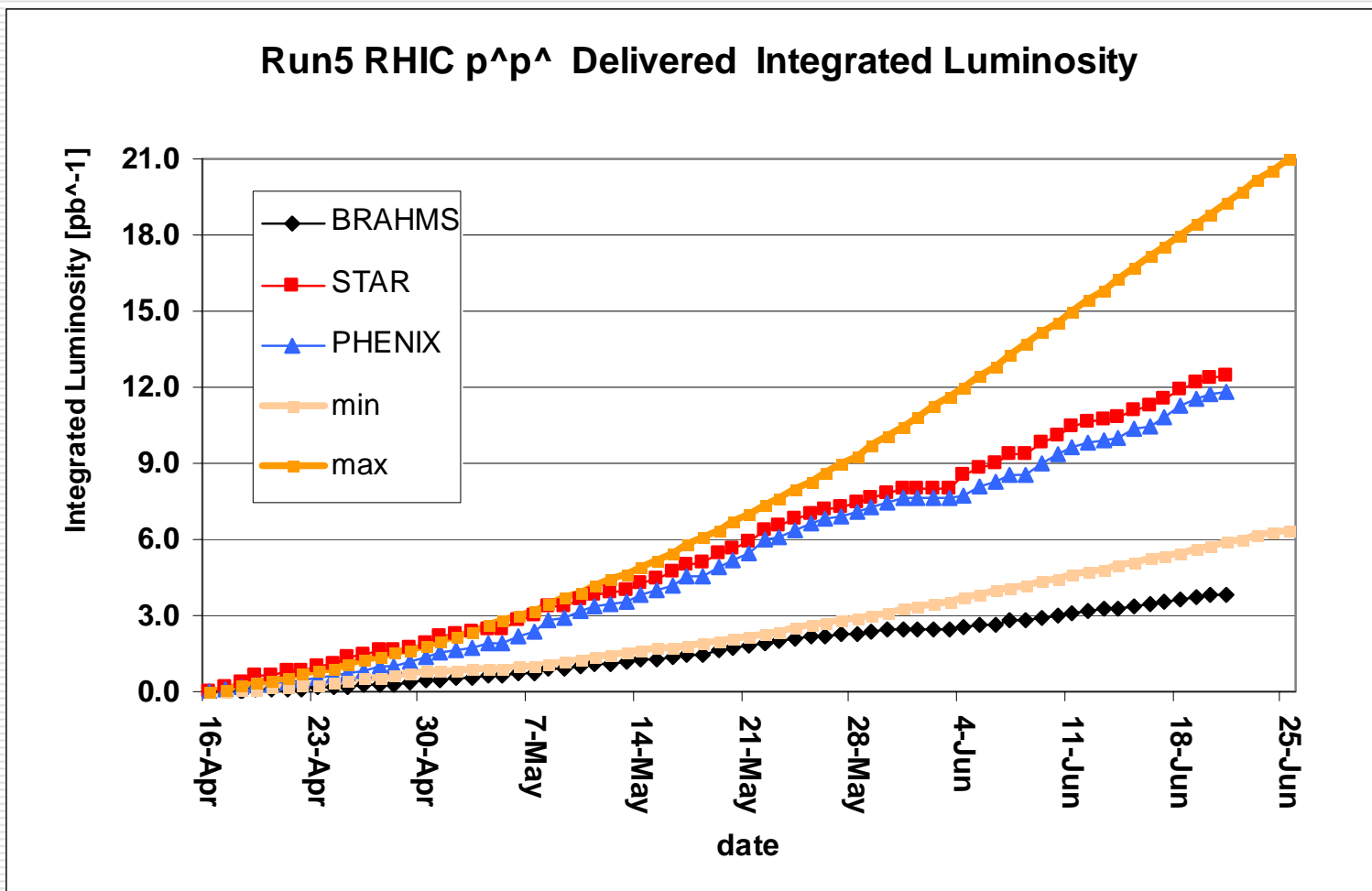
Summary

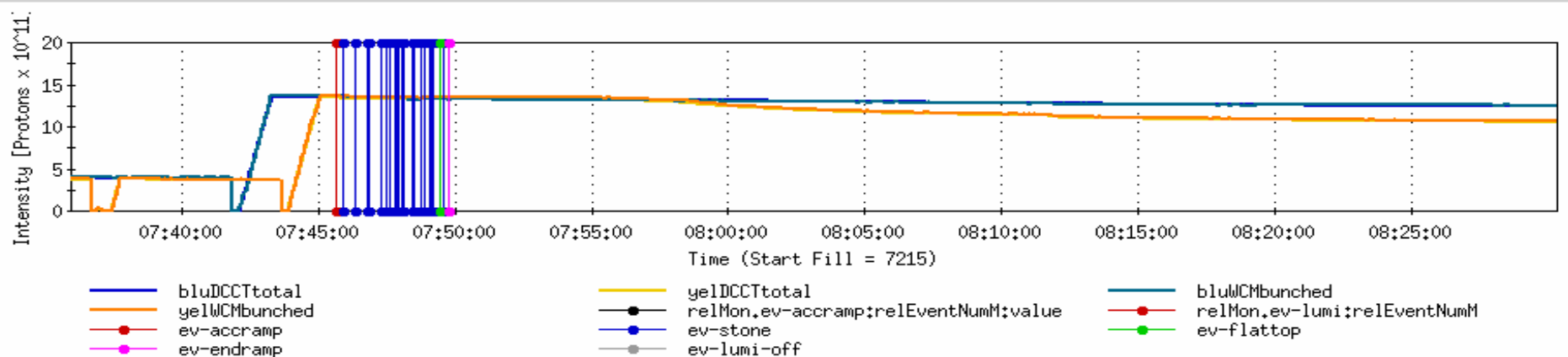
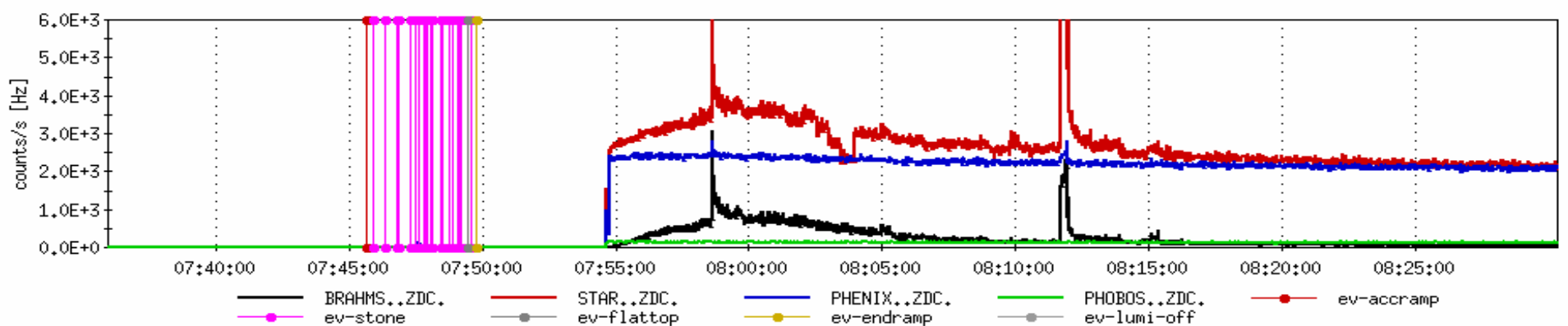
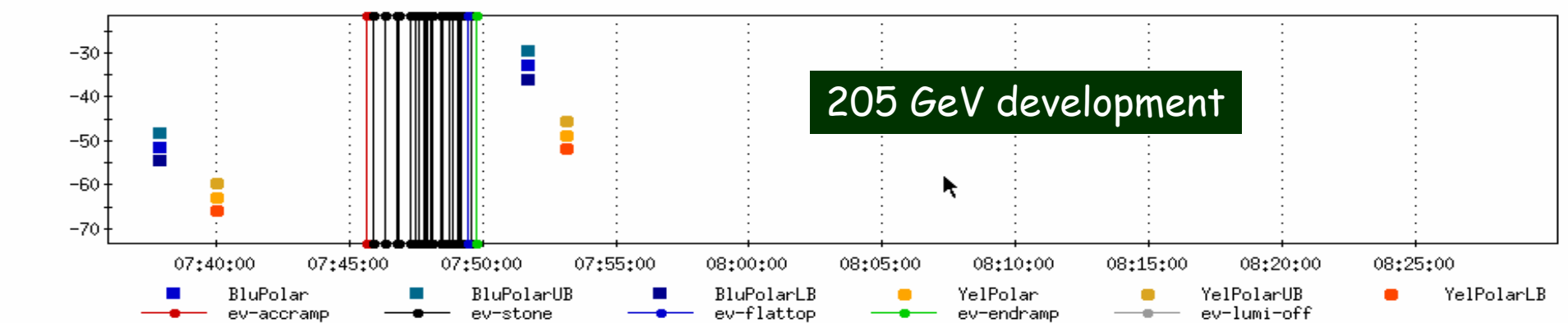
- ❑ Machine performed well. The total delivered luminosity is well within the C-AD projection. The achieved polarization is above the projection thanks to the great performance of the polarized proton source and the injectors.
- ❑ Successfully operated with 110 bunches with 1.0×10^{11} protons per bunch. Tests of accelerating 110 bunches with 1.5×10^{11} protons per bunch will take place on Friday APEX session.
 - Add more NEG coated pipes
 - Improve the vacuum condition at CNI polarimeter
- ❑ Design strategies to fight against the orbit daily variation
- ❑ 205 GeV development demonstrated the depolarization resonance is sensitive to the orbit distortion. Machine re-alignment will be arranged during the shutdown

Acknowledgement

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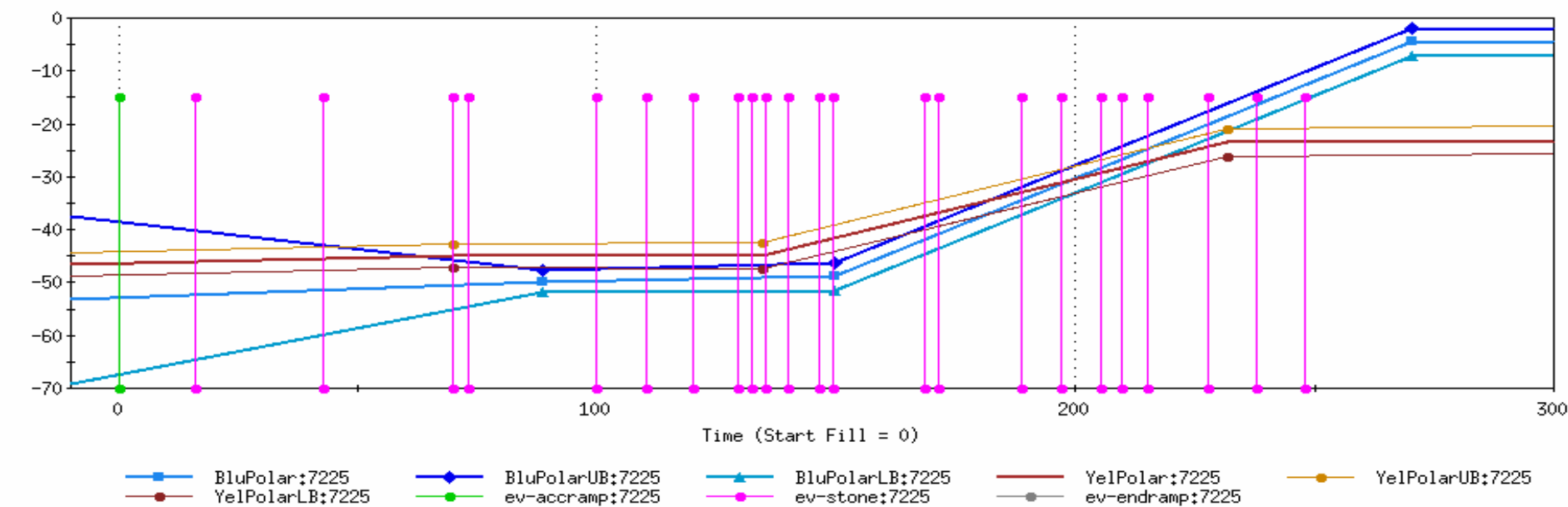
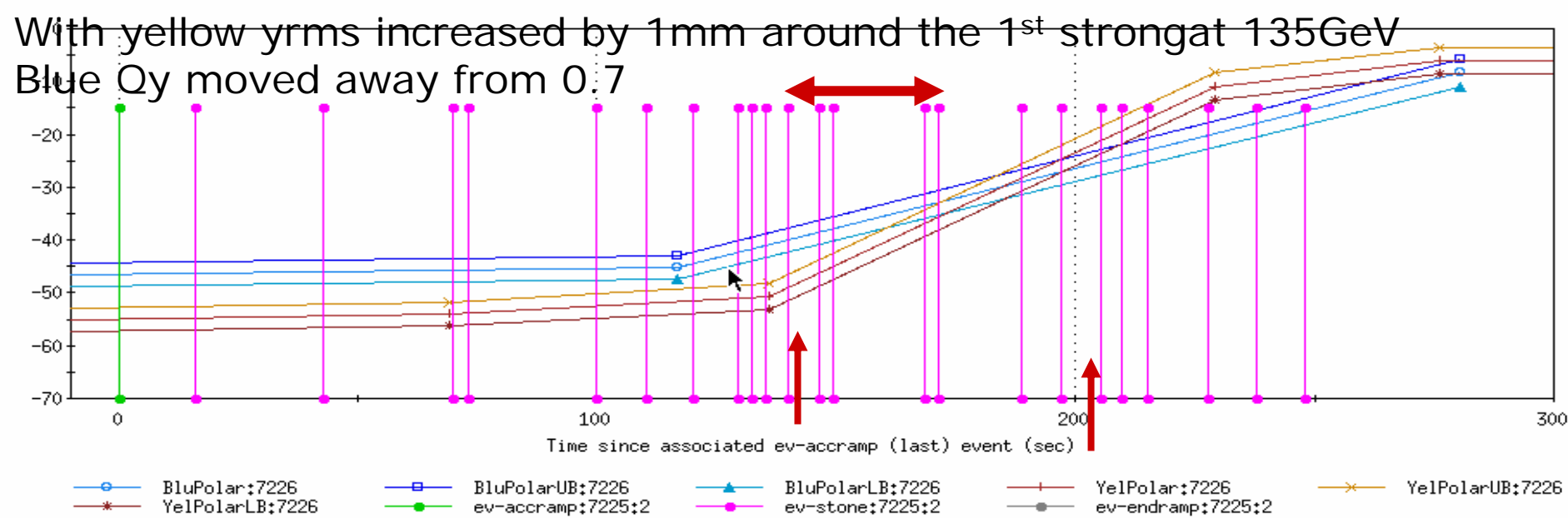
RHIC integrated luminosity: soft-physics-on ~ ev-lumi-off





June 23, 2005

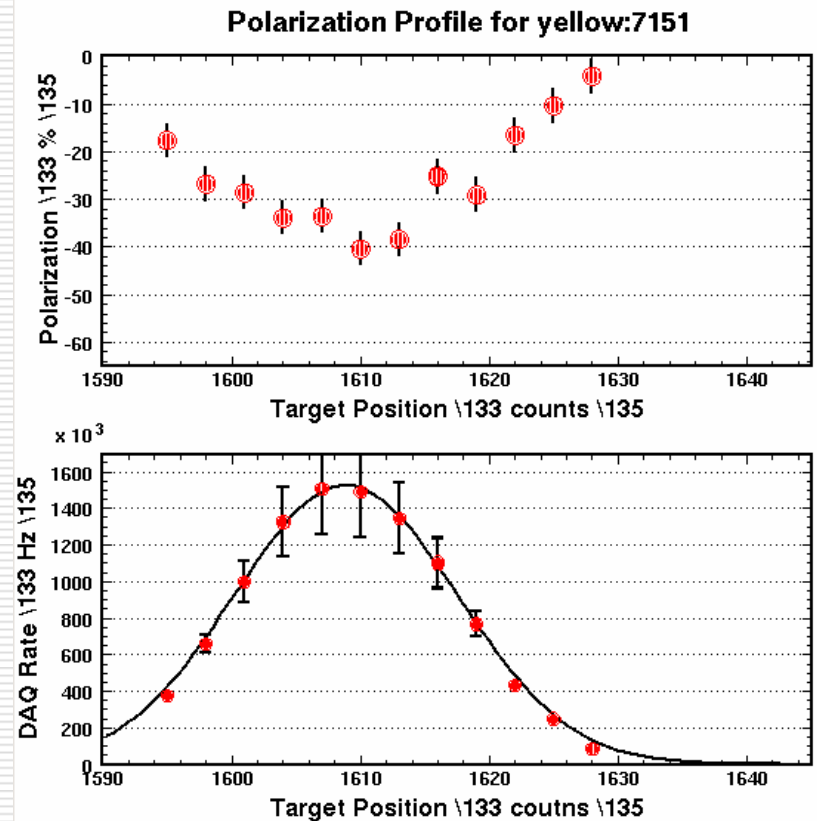
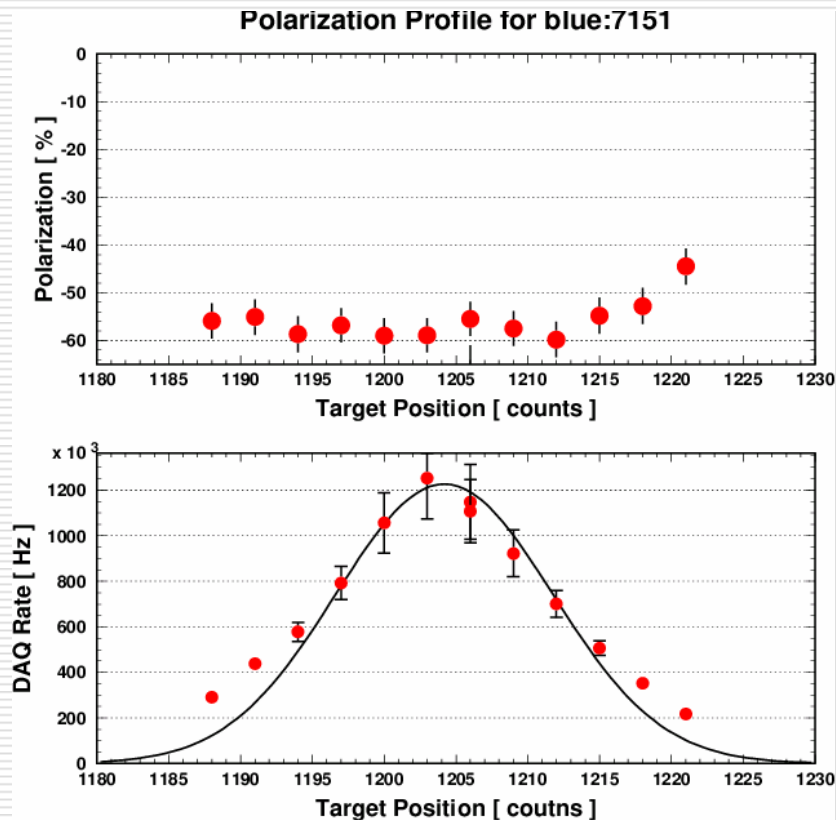
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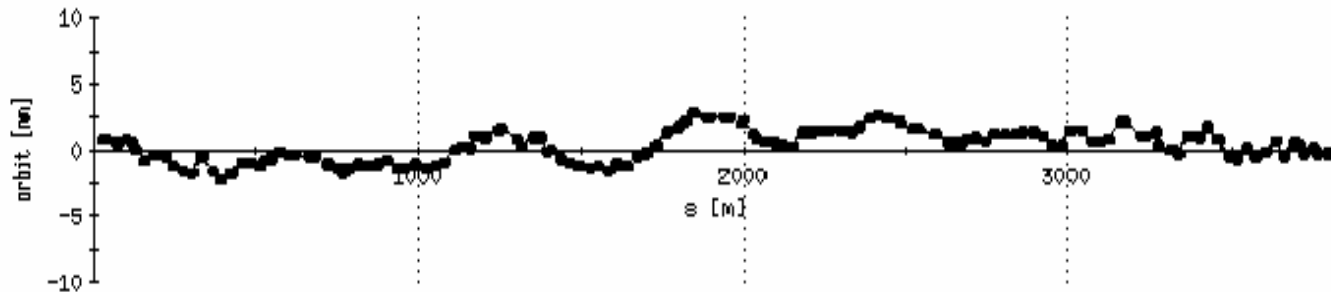
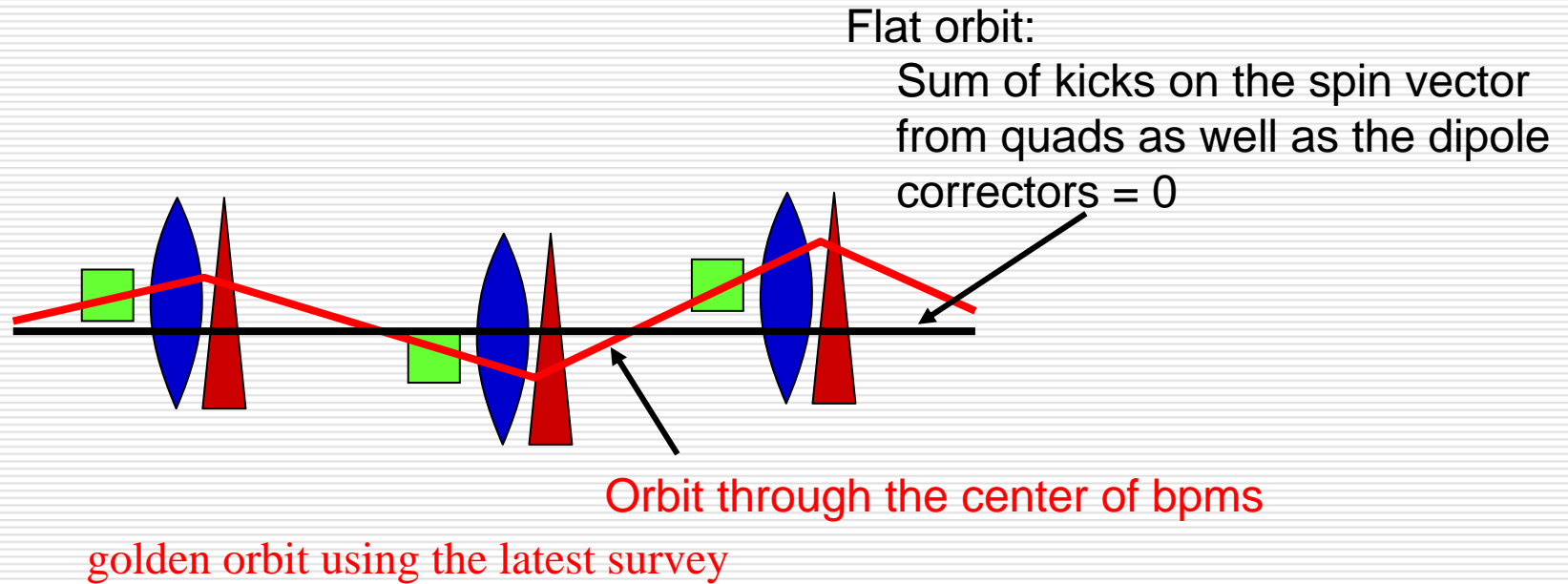
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Polarization profile

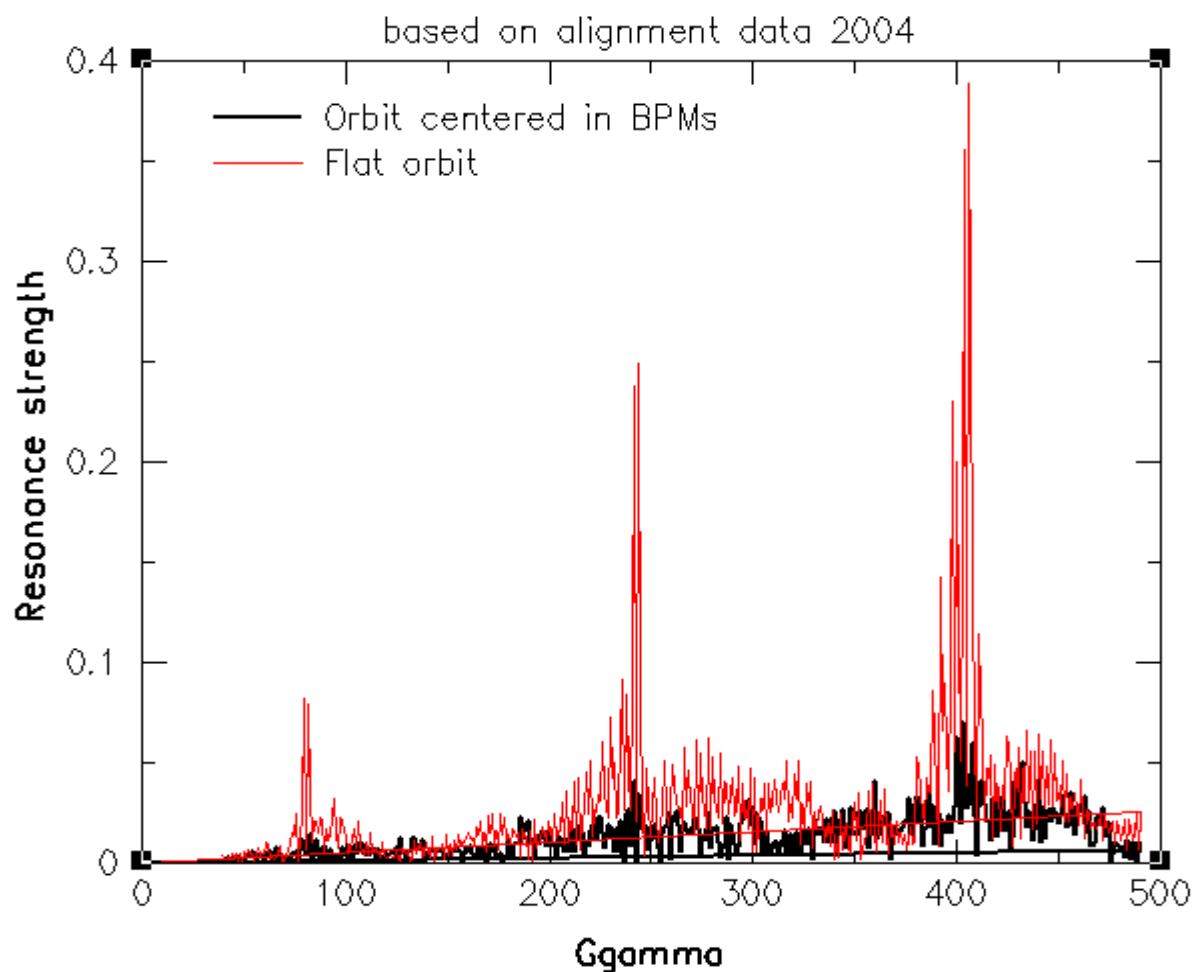


flat orbit and zero orbit

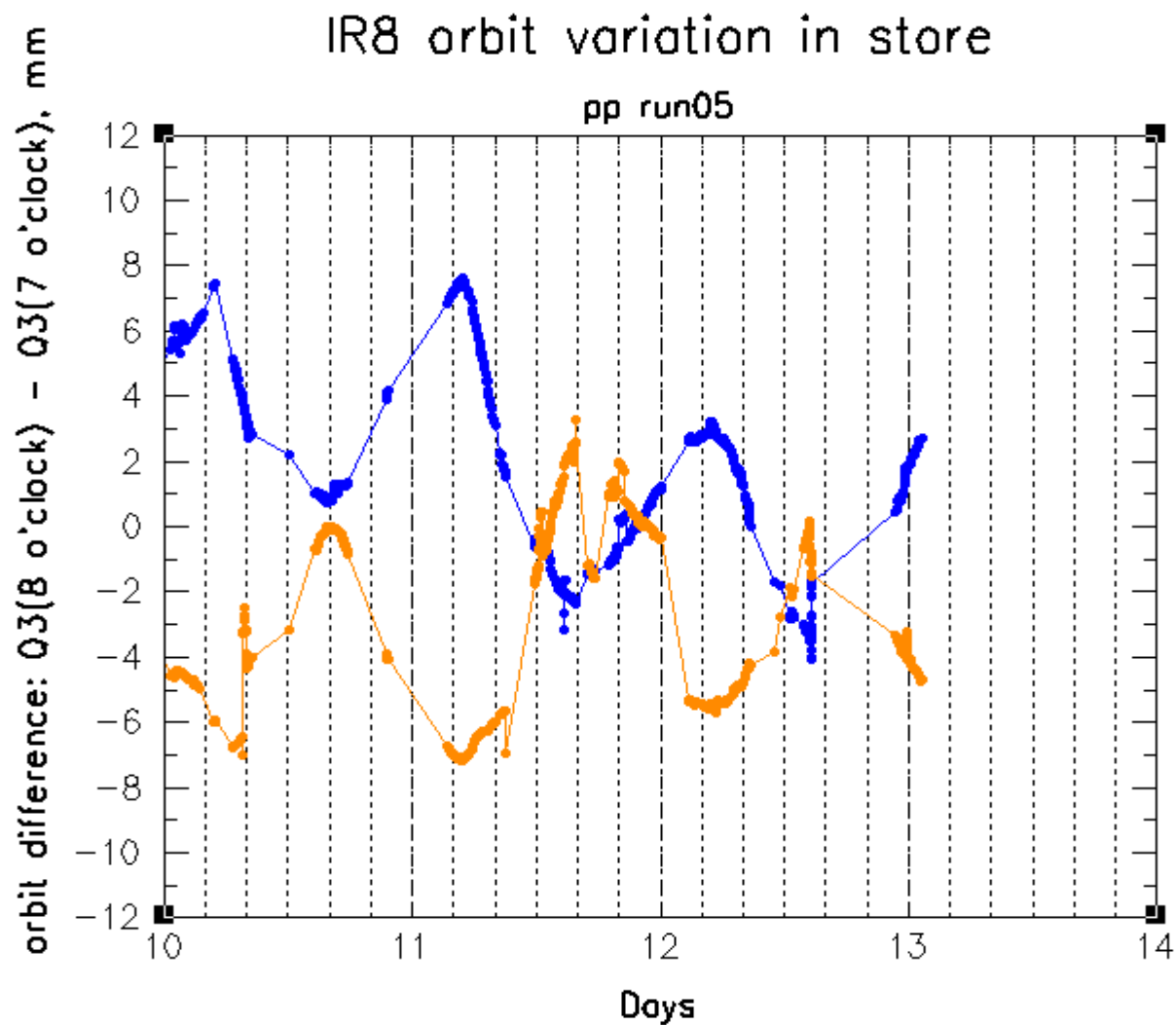


Imperfection resonance w. flat orbit

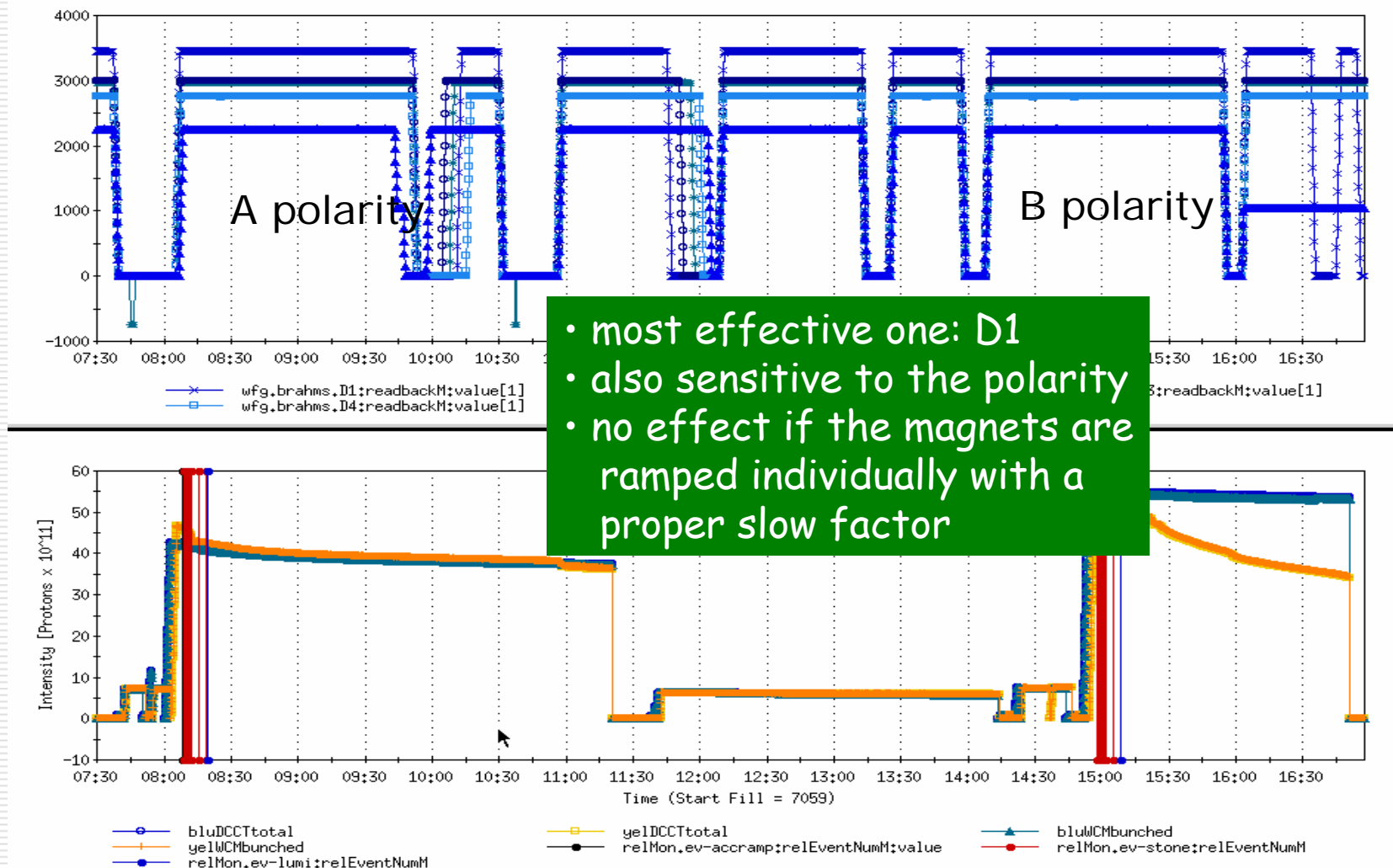
Imperfection spin resonances for two orbit types



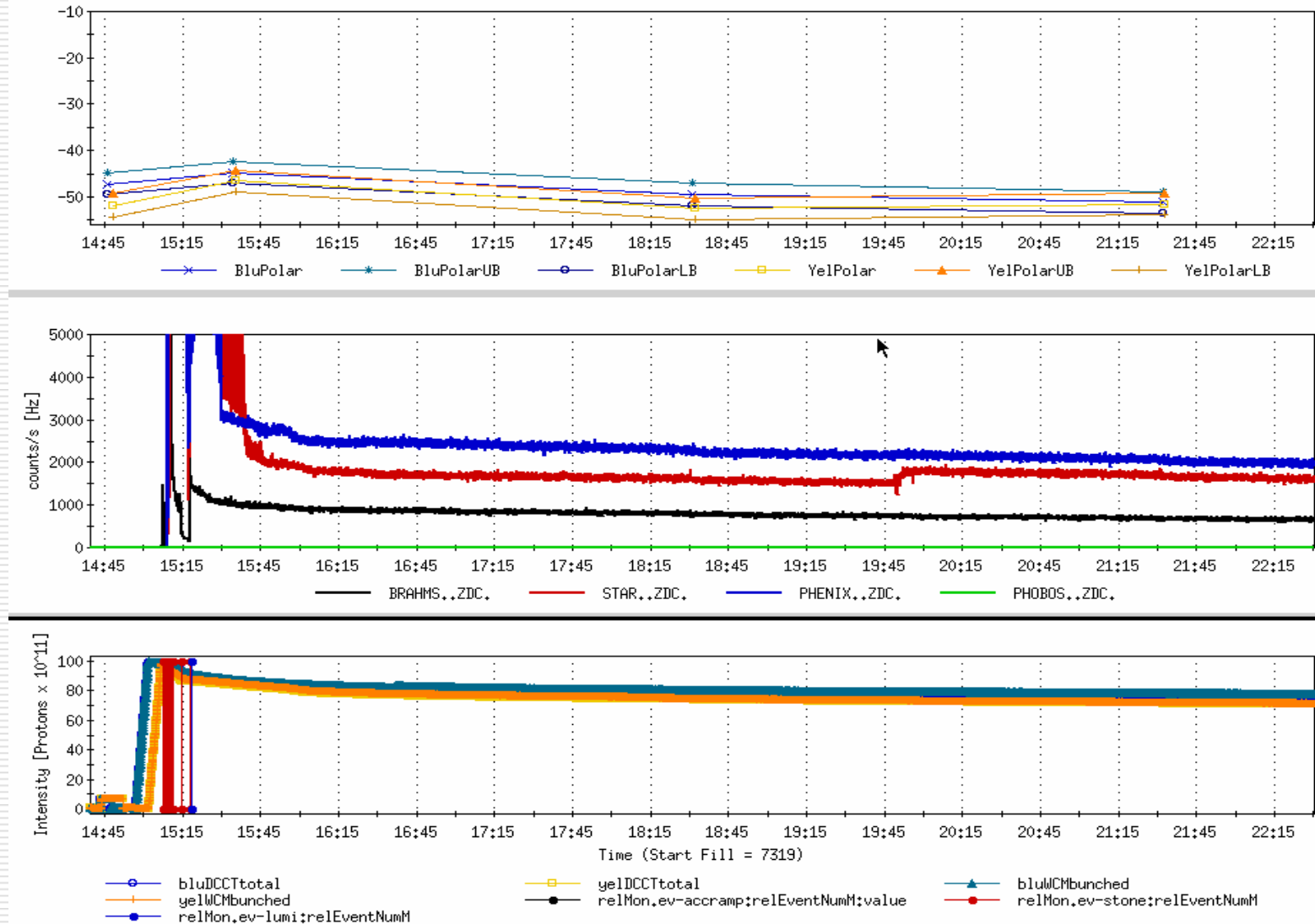
Orbit daily variation



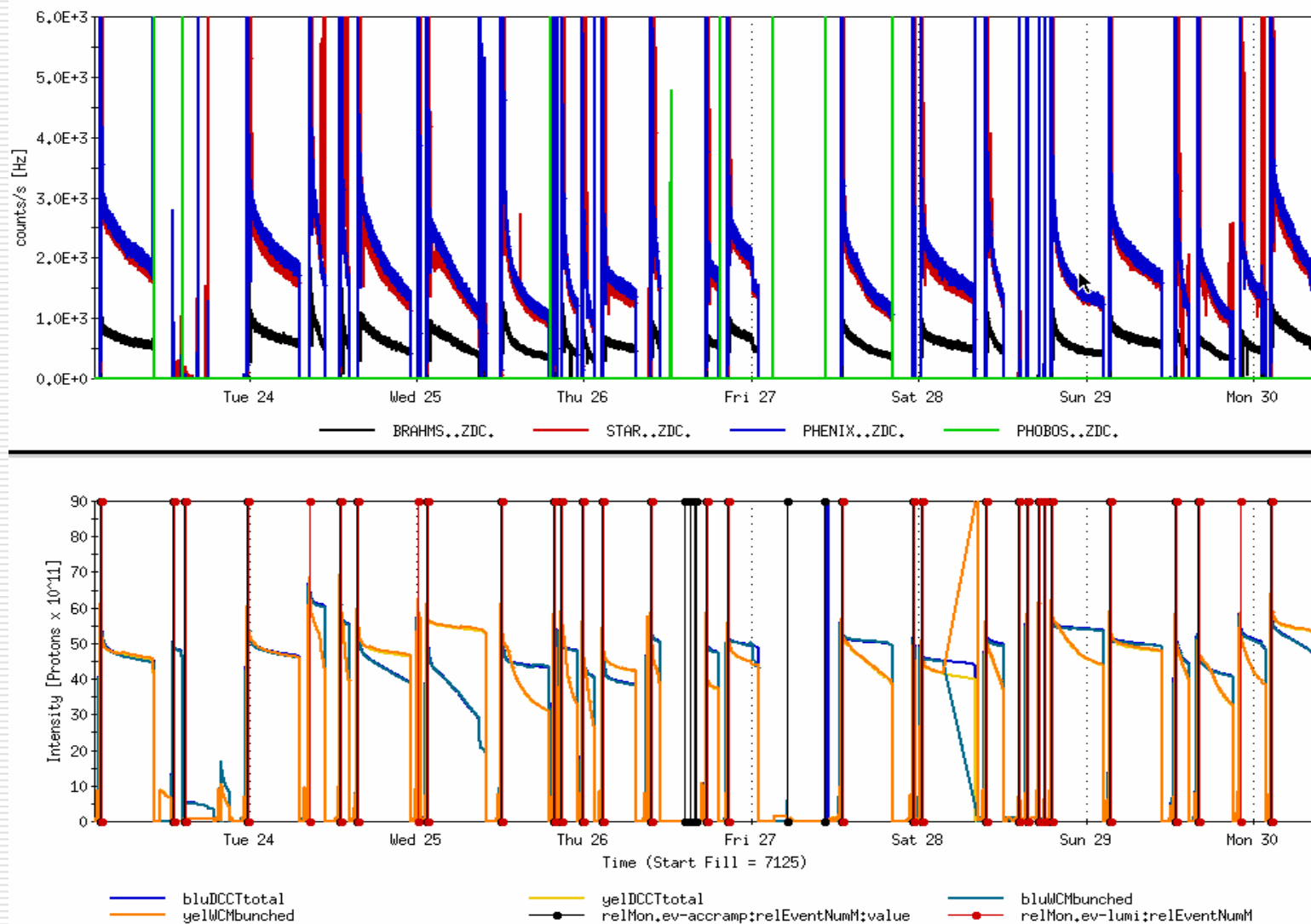
Effect of Brahms magnets



111x111 bunches



Beam lifetime at store



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